

substrate **4**, and the superimposed noise could cause errors in detecting a pressed position.

[0111] Because the drive electrodes **2a** and **2b** adhered to the piezoelectric substrate **2** are interposed between the display device, the light-emitting element, or the wiring for them on the rear side of the support electrode **4**, and the leader electrodes **9a** and **9b** in the present embodiment, the electrodes **2a** and **2b** serve as a shield to the leader electrodes **9a** and **9b**, for cutting off high frequency noise. Thus, errors in detecting the pressed position are prevented.

[0112] While the drive voltage is impressed on the piezoelectric substrate **2** when the pressure on the movable plate **3** is detected for the first time in the first and second embodiments, the drive voltage may be impressed on the piezoelectric substrate **2** to vibrate the movable plate **3** or the support substrate **4** when the point on the display that is pressed corresponds to the location of a specific icon displayed on the display device based on the detected pressed position data in addition to the detected pressure. The drive voltage waveform may be changed to correspond to different individual icons, so that the vibration action which an operator feels changes to indicate the type of action selected. This is useful of sighted persons, but is vital for a blind operator who can feel the type of icon contacted by the fingertip.

[0113] Though the embodiments are described with reference to resistance-sensitive tablet type analog touch panel input devices **1** and **30**, the touch panel input devices **1** and **30** may be so-called digital type touch panel input devices in which the movable conductor layer **6** and the fixed conductor layer **7** are respectively divided into a large number of parallel strips of movable contact pieces and fixed contact pieces. The strips are attached to opposing surfaces of the movable plate **3** and support substrate **4** such that they are orthogonal to each other. This forms a matrix of contact positions. The digital type touch panel input device detects a pressed position on the movable plate **3** based on a contact position of the movable contact piece and the fixed contact piece which are in contact with each other.

[0114] The piezoelectric substrate may be fixed to the front surface or the rear surface of the movable plate **3** as long as it has a certain degree of stiffness. The movable plate or the support substrate to which the piezoelectric substrate is fixed may be made of any material such as glass, plastic, or metal as long as it has sufficient stiffness to generate vibration when the piezoelectric substrate contracts and expands.

[0115] A low drive voltage can efficiently vibrate the movable plate or the support substrate when the pair of drive electrodes are affixed to the front and rear surfaces opposing to each other in the thickness direction of the piezoelectric substrate, and the piezoelectric substrate is fixed to the movable plate or the support substrate through one of the drive electrode. An electric field is present in the thickness direction of the piezoelectric substrate as shown in the embodiments. However, the method of fixing the drive electrodes is not limited to the described embodiments, and the drive electrodes may be fixed to side surfaces of the piezoelectric substrate orthogonal to the movable plate or the support substrate. The piezoelectric substrate may be directly fixed to the movable plate or to the support substrate.

[0116] When the piezoelectric substrate is attached to the movable plate **3** or the support substrate **4** as in the present invention, different types of applications are derived in addition to directly generating vibration.

[0117] For example, with the piezoelectric substrate fixed to the movable plate, a pressing operation generates a pressure from the movable plate. A voltage generated by distortion of the piezoelectric substrate bent by the pressure is detected to detect a pressure on the touch panel input device. This voltage may be used in applications for using the piezoelectric effect of the piezoelectric substrate (using a voltage signal generated from mechanical distortion). If this output voltage is integrated in an integration circuit, the force exerted on the movable plate can be determined.

[0118] When acceleration is applied on the piezoelectric substrate, the piezoelectric effect provides a voltage as well. Thus, the piezoelectric substrate can be applied to an energy saving circuit. This circuit may be the only one necessary to monitor an output from the piezoelectric substrate in a standby state. That is, the monitor is completely quiescent in the standby state, and is self-powered by the piezoelectric voltage. When an operator takes out a device bearing the touch panel input device, the circuit detects the voltage caused by an acceleration applied on the piezoelectric substrate. This voltage enables turning on the other main circuits.

[0119] If the piezoelectric substrate is exposed on the surface of the movable plate, the piezoelectric substrate may be vibrated by sound pressure from the speech of an operator. Thus, the piezoelectric substrate can be used as a simple microphone.

[0120] Further, when the piezoelectric substrates are fixed on two edges opposing to each other on the input operation surface, because bends transmitted to the individual piezoelectric substrates depend on distances from a pressed position to the fixed positions of the piezoelectric substrates when a pressure is applied, it is possible to detect the pressed position by comparing the outputs from the pair of piezoelectric substrates.

[0121] As described above, because the movable plate **3** and the support substrate **4**, which constitute the touch panel input devices **1** and **30**, vibrate by themselves according to the first aspect of the invention, it is not necessary to provide a vibration source in a space independent to these devices. Thus, the thickness and the size of the entire input devices is not increased.

[0122] Because the movable plate **3** and the support substrate **4** vibrate by themselves, it is not necessary to provide a support mechanism and a transmission mechanism for a vibration generating source. Because noise is not generated or vibration energy is not damped by transmission, a small amount of drive voltage efficiently generates vibration. Thus, simply generating momentary vibration without maintaining the vibration for a certain period makes the vibration sensitive to an operator. A simple circuit without an oscillation circuit can drive the piezoelectric substrate.

[0123] Because the movable plate **3** and the support substrate **4** vibrate simply following the contraction and expansion of the piezoelectric substrate **2**, it is possible to transmit the vibration without delay after pressure is detected, and to